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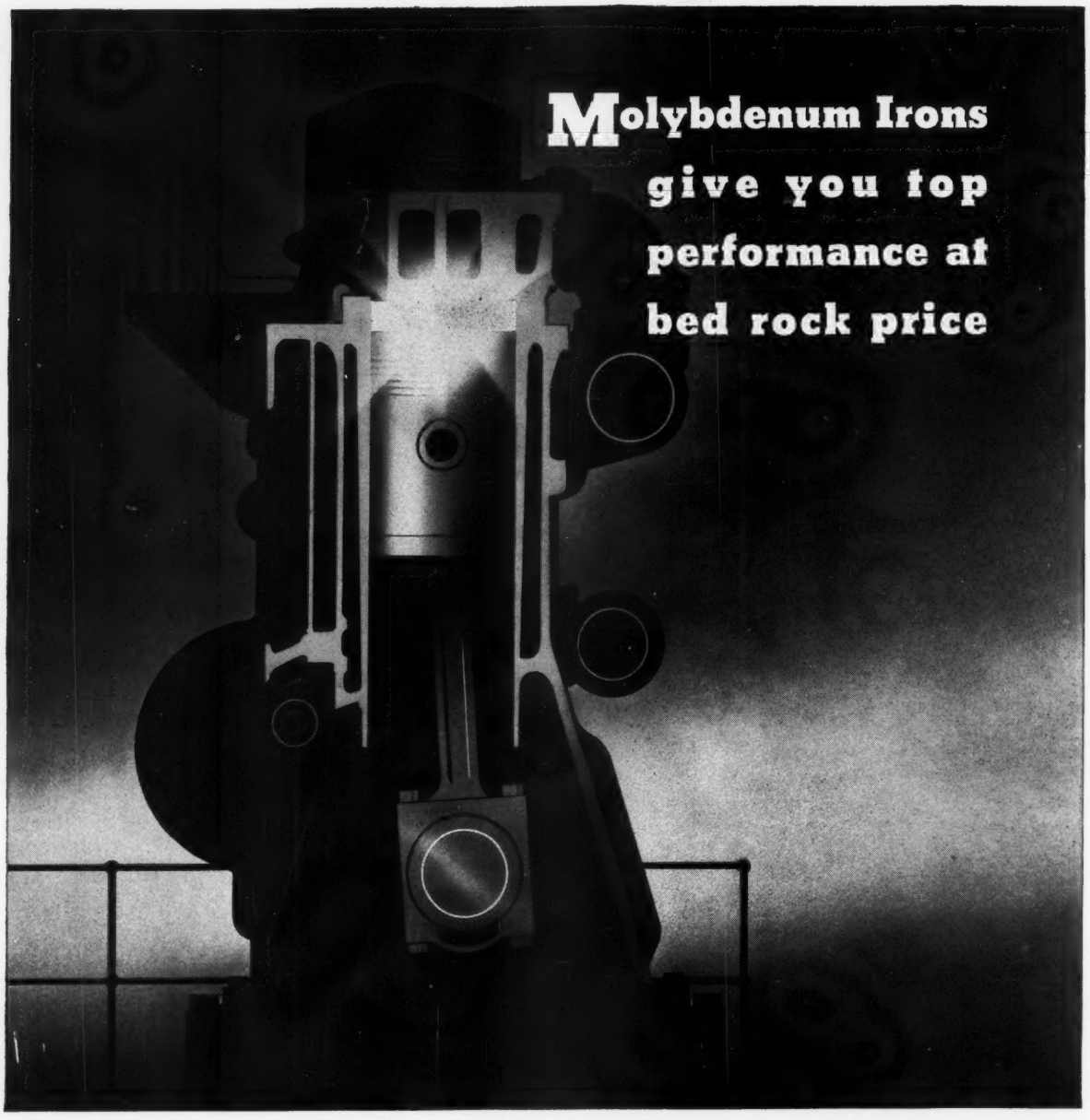

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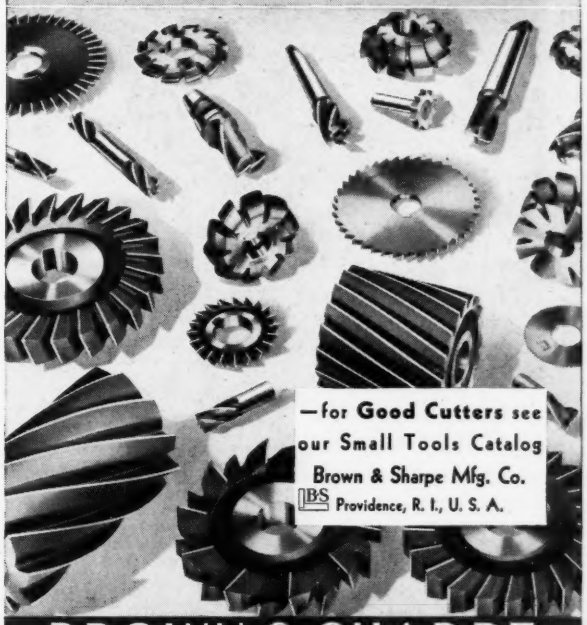

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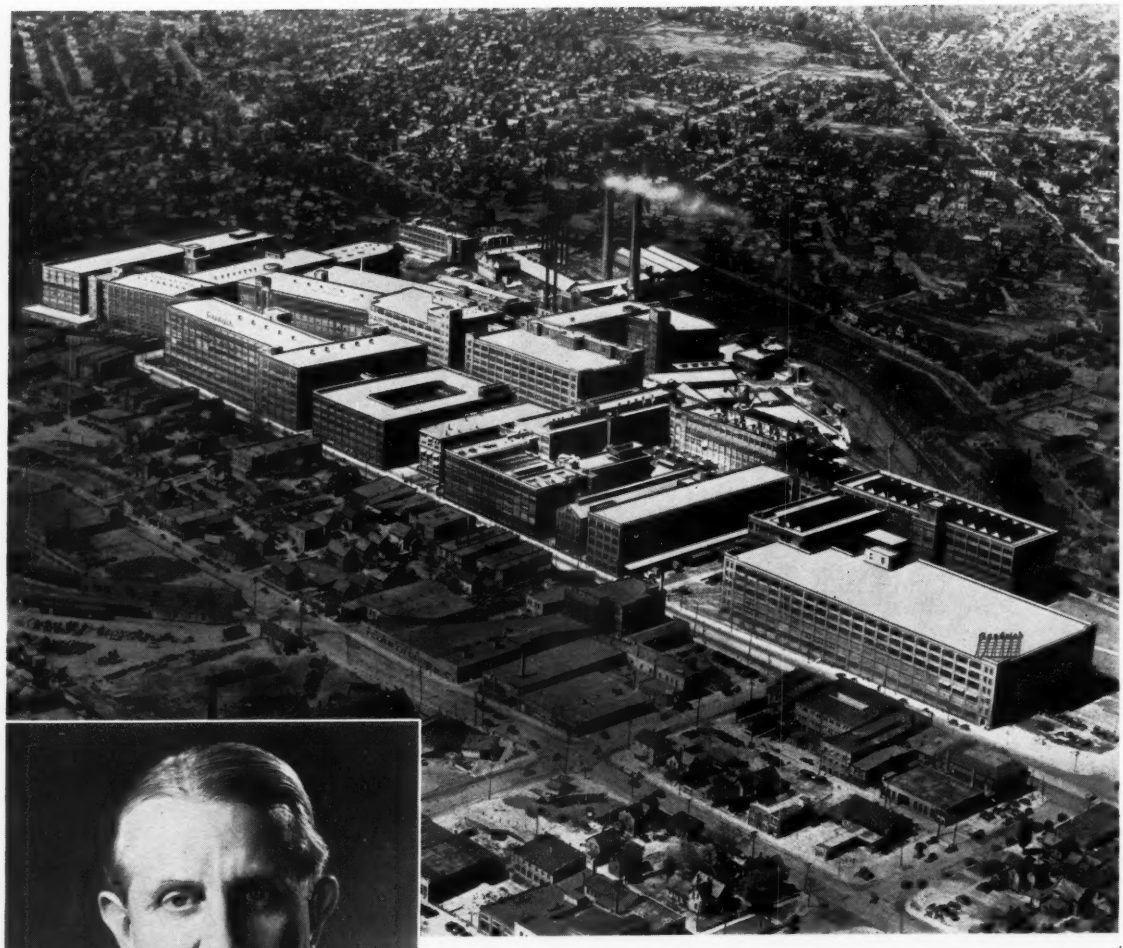


John L. Collyer M.E. '17, president of the B. F. Goodrich Company, and the company's huge plant at Akron, Ohio.

Outstanding during his undergraduate years as president of his class and commodore of varsity crew, Mr. Collyer has maintained a high record of achievement since his graduation from Cornell University.

Is Our "Rubber Lifeline" Threatened?

How synthetic rubber conserves and replaces natural product in many unique defense applications

JOHN L. COLLYER, M.E. '17

WITHIN the past few months, the United States has made rapid strides toward wresting the synthetic rubber leadership of the world from Nazi Germany.

Driven by the most urgent economic necessity, Germany has been manufacturing synthetic rubber by various processes since the middle of the World War. Several types of synthetic rubber have been developed in the United States and have been manufactured in very small quantities for ten years or more for specialized industrial uses. But it was only in June of 1940 that American industrial scientists brought forth a synthetic rubber, developed from American raw materials by American processes and capable of replacing the natural product for practically all its essential uses, including tires.

That substance is Ameripol, made from butadiene, a product from American petroleum joined with other materials also of American origin. Ameripol is the result of 15 years of research by a staff of B. F. Goodrich scientists. It is being used in the manufacture of the first synthetic rubber automobile tires to reach the open market in this country and for many other valuable applications in national defense.

Pushing Production

Since about 75 per cent of all the rubber we import goes into tires, our rivalry of the German production rate may be said to date from the announcement of Ameripol in June, 1940. At that time, the rubber position of the United States was one of the biggest question marks on the blue prints of national defense planning. Nazi Panzer divisions shod with synthetic rubber had blasted through the Lowlands and were rolling toward Paris. Spurred by the Nazi warlords, the Germans had attained a synthetic rubber capacity of 20,000 tons a year, according to estimates of the United States Department of Commerce.

At about the same time, Japan was preparing to enter the Axis, and this country faced the prospect that at any moment a crisis in the Far East might snap our "rubber lifeline" to the Far Eastern plantations from which we obtain 97 per cent of our crude rubber.

Today, after 16 months of determined and historic effort by the rubber industry and the government, that dismal picture is somewhat brighter.

In contrast to the almost negligible 1,750 tons of snythetic rubber which the entire nation turned out in 1939, the privately financed synthetic rubber capacity developed by Goodrich now has a capacity of 6,000 long tons a year. Upon completion next year of a 10,000-ton plant now being built at Louisville, Ky., under terms of a $2,750,000 contract with the government's Defense Plant Corporation, a single American firm, the Hycar Chemical Company,—a straight-line synthetic rubber production unit organized by Goodrich and the Phillips Petroleum Company only 14 months ago—will shortly have a capacity of 16,000 long tons a year. This is approximately four times the synthetic rubber output of the entire United States last year.

Paralleling this development have been the results achieved by a number of other companies both in and out of the rubber industry proper. Estimates are that these companies, which include duPont, Standard Oil, Goodyear, Firestone, and Dow Chemical, will, by the end of next year, have developed privately financed production of 30,000 tons of various types of synthetic rubber per year. In addition, three rubber companies, Goodyear, Firestone, and United States, are sharing in the government's Defense Plant Corporation program and are constructing 10,000-ton plants similar to that which Goodrich is building at Louisville. The Government-owned plants will be in operation in from 15 to 18 months, it is expected.

Principal Types

All in all, the total American production of synthetic rubber of various types is expected to approximate 70,000 tons a year by the end of 1942. Thus, the United States

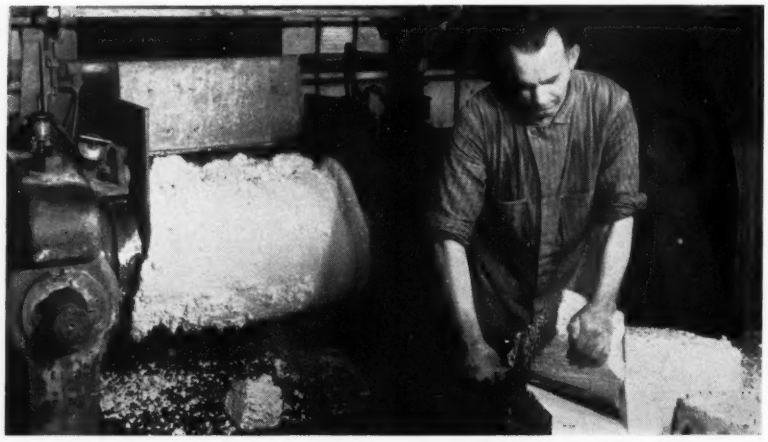
AFTER graduating in 1917, John L. Collyer joined the staff of the Bethlehem Ship Building Corporation, rapidly progressing to general superintendent, and in 1924 he accepted a position as vice-president of the Dunlop Tire and Rubber Company of Buffalo.

In 1931, he was appointed director of Dunlop manufacture throughout the world and in 1936 was elected to the company's board of directors with the responsibility for the direction of all Dunlop manufacturing in its 12 plants.

In 1936 he was made joint managing director of Dunlop, which position he resigned to accepted the presidency of The B. F. Goodrich Company. He is at present a trustee of Cornell University.

by fast work and the application of its technical skill, is moving into a dominant position with regard to synthetic rubber. In less than a year and a half, the nation has made a substantial start toward guaranteeing its supplies of a material which is absolutely indispensable to our motorized and industrialized civilization, as well as to almost all phases of national defense.

At this point, it may be well to examine some of the principal types of synthetic rubber. According to records in the United States Bureau of Standards, there are at least 29 kinds of synthetic rubber, over a dozen of which are being currently used in this country. Nearly all of them are better in some respects than natural rubber—but they are also from two to five times more expensive.



Plastic blocks of raw Ameripol are cut into small pieces to be sheeted on the wash mill.

The basic chemical material for these is butadiene, a liquified hydrocarbon gas whose molecule consists of four atoms of carbon and six of hydrogen tied together in a specific arrangement. In German experiments, the favored method of obtaining this gas was from coal. In the United States, butadiene is made from petroleum by passing it through a highly heated tube.

Synthetic rubber made from butadiene is somewhat similar to the rubber present in natural latex. The molecules of both products are hooked together in long chains of several hundred. In the crude rubber of commerce, this has been done by natural processes. In synthetic rubber butadiene units are hooked together by polymerization and from aggregates emulsified in water to give a synthetic latex very similiar to that of natural rubber.

For purposes of classification there are three principal types of synthetic diene rubber: Neoprene, butadiene tire-type, and butadiene oil-resisting type. Ameripol can be made in either of the latter two types.

All of these various types of synthetic rubber have proved themselves capable of replacing the natural product for some essential uses. But only Ameripol, to date, has shown the ability to double for natural rubber in the American passenger car tire field where technical skill and years of research have combined to produce the world's highest standards of service and performance. Several thousand American motorists have been using Ameripol tires now for a year or more, and several hundred leading American corporations have adopted these tires for use on company cars and light trucks. Performance reports indicate that tires made of Ameripol measure up to the standards of quality and service established by natural rubber.

But it should not be assumed that this answers automatically all of our rubber problems. It is one thing to match the synthetic rubber output of Germany where civilian owned automobiles are a rarity; it is another to produce the vast quantities of synthetic rubber which would be required by this rubberized and motorized nation if an emergency shuts off imports from the Far East.

Luckily, we do not now have to face that problem in the bald aspects of June, 1940. The government has done an outstanding job in building up reserve stockpiles of crude rubber which are now large enough to meet almost a full year's normal requirements, and the rubber industry has extended fullest cooperation.

By limiting consumption of crude rubber to 300,000 long tons during the latter half of 1941, and to a total of about 725,000 long tons for the entire year, the nation is accumulating reserves which would at least take care of military requirements and the most urgent industrial and civilian demands.

Synthetic's Future

But these very factors which have led millions of Americans who depend on rubber to heave a sigh of relief have caused some to doubt the future role of synthetic rubber in our national economy. Some point to the price differential between man-made rubber and Nature's product and emphasize that in comparatively recent times crude rubber has been produced and sold for as little as three cents a pound.

The answer, in my opinion, is that while we have developed synthetic rubber primarily as a replacement for natural rubber in an emergency, the future of the new and fast-growing American synthetic rubber industry does not necessarily depend upon replacement of natural rubber.

Though seemingly paradoxical, this statement is based on a solid scientific fact. Natural rubber and oil do not get along well together. In contacts with petroleum products, natural rubber tends to swell and disintegrate. Ameripol, on the other hand, even though a chemical cousin of petroleum, retains its valuable rubber characteristics even when submerged in oil and hydrocarbon solvents.

This characteristic takes on added significance when we realize that many scientists are forecasting the future in terms of an "age of petro-

leum". They make this prophecy not merely because petroleum will serve as fuel and lubrication for increasing numbers of internal combustion engines, but because petroleum is the principal source of the hydrocarbon molecule which modern industrial science can transmute into many new and valuable raw materials.

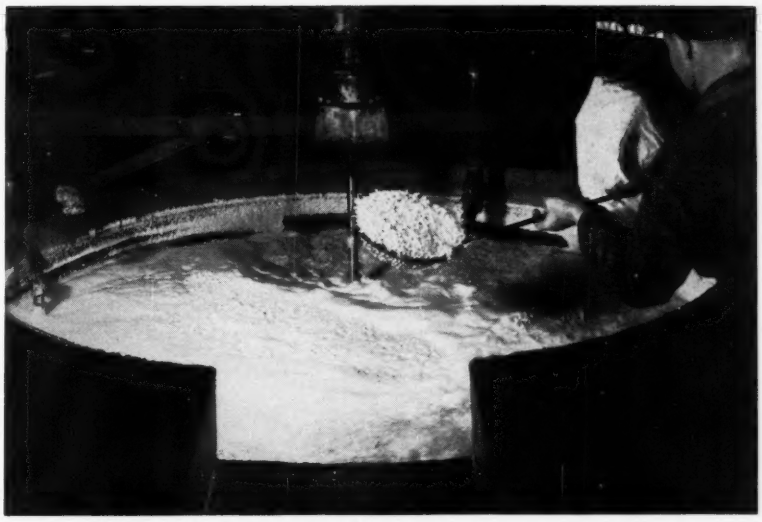
Synthetic's Superiority

We have gone into the development of Ameripol and synthetic rubber products because of several highly significant factors. In addition to being very similar in appearance to natural rubber, it can be compounded and vulcanized on standard rubber manufacturing machinery to give a very wide range of valuable properties in the finished product.

It excels natural rubber in four important service properties, equals it in six and is only slightly below natural standards in three, which can be largely remedied by skillful compounding. It is superior to natural rubber in its resistance to oxidation, heat, and aging as well as to oil. It equals Nature's product in range of hardness, tensile strength, permanent set, and in resistance to abrasion, acids, and alkalies. It is only slightly below natural standards in elasticity, tear resistance, and reaction to sub-freezing temperatures but these can be compensated for in compounding.

Ameripol's resistance to oils is especially spectacular and is borne out by the results of tests in which various types of synthetic rubber were immersed in various oils for 48 hours. The tabulation of results appears in table 1.

This property has resulted in the wide use of Ameripol throughout the petroleum industry where oil resistance must be combined with the elasticity and other characteristics of rubber. Hose for filling



Raw synthetic rubber after coagulation showing closeup of strainer full of curd-like particles.

station pumps, for loading and unloading tank cars and tankers, for fueling all types of vehicles and for use in the oil fields is one of the most rapidly expanding markets.

But applications are by no means limited to work in connection with petroleum and hydrocarbon products. One of its most valuable new uses is as molded printing plates on both high-speed and job presses. In this field where "rubber type" was once a perennial industry joke played on unsuspecting apprentices, rubber printing plates are marking up valuable savings in time and cost, especially in work with the new "flash" and oily inks used now on high-speed printing jobs. In the printing of Ernest Hemingway's best - seller, "For Whom The Bells Toll", synthetic rubber was molded into plates and put on the press in something like ten minutes, a time factor which can be appreciated by comparison with the usual time requirements of metal stereotyping and electrotyping. Furthermore, the synthetic rubber plates can be adjusted to obtain what printers call a "kiss impression" by which the impression of the plate onto paper is so light that consumption of expensive inks is considerably reduced.

Conducts Electricity

One characteristic of synthetic rubber is proving of especial value in aviation and defense work. The man-made product, unlike natural rubber, will conduct electricity. Thus it is used in compounds or by itself to gain conductivity where desired. One such application is found in the Goodrich De-Icer which is used the world over to enable military and transport planes to carry on in the face of adverse weather conditions. The flow of air across the body of a plane builds up charges of static electricity which are sometimes as high as 500,000 volts. If unleashed, this electricity would cause serious damage. But through use of conductive compounds, these charges are now bled off harmlessly. A similar application is made in the tires of

(*Continued on page* 24)

TABLE I — Volume increase after 48 hours' immersion at room temperature.

Liquid	Ameripol	Synthetic A	Synthetic B	Synthetic C
High Test Gasoline	0	18%	3%	1%
Light Fuel Oil	0	16%	4%	0
Gasoline with 5% Benzol	0	27%	3%	6%
100% Benzol	86%	177%	71%	122%

Troops crossing stream in assault boats under fire.

All in the Life of the Army Engineer

JACK H. McMINN, CE '44

Cuts Courtesy ARMY ORDNANCE MAGAZINE

THE Corps of Engineers of the United States Army, which during peacetime has mainly been concerned with flood control, harbor improvements, and Work Projects Administration jobs, has not neglected the study of wartime engineering practices. Experiments are constantly being made with offensive and defensive methods at the Army Engineering School at Fort Belvoir, Virginia. The courses include a study of technique and tactics, surveying, drafting, map reproduction, and water purification. It has become one of the largest special service schools of the Army, training 1,700 officers and 1,500 enlisted men annually.

On June 30, 1939, the United States Army numbered about 180,000 officers and enlisted men, of whom 6,000—or one man in 30—were engineers. By June 30, 1941, this number had swelled to 1,400,000 of which 85,000—or one in 16—were engineers. In active warfare this proportion would probably rise to one man in eight.

Each of the "square" divisions, its major component being four infantry regiments, has one regiment of engineers at present. Each "triangular" division of three infantry regiments and each armored division has a battalion of engineers. Each Army corps has one or two combat engineer regiments and a topographic company. Each field army has three regiments and six separate battalions of general service engineers, two dump-truck companies, two heavy pontoon battalions, a camouflage battalion, a water-supply battalion, a shop company, and a depot company.

When our Army moves cross country, Army engineers have to outline the route, build roads for motorized forces and supplies, build bridges across rivers for troop use, lay rails to the operating base, and operate trains.

Engineers establish bridgeheads in enemy territory. Engineers plant mines and construct tank traps on unprotected flanks. It is the corps of Engineers which camouflages artillery positions and supply dumps. In emergencies engineers throw down their picks and jackhammers and fight with rifles and machine guns. The exploits of combat engineer troops of Germany have put new emphasis on the importance of their duties.

The maintenance of existing roads and bridges and the construction of new ones probably would be the principal task of engineers in wartime. Mechanized military forces are hard on roads.

The construction of new concrete roads is impracticable close to the front. An eighteen foot macadam road will meet the needs of an infantry division fighting as far as seventy-five miles from its railhead. Each infantry division requires one such road. Dirt, plank, gravel, or corduroy construction will suffice for lighter traffic. For quick construction a tread road is built, supplying a surface for only the wheels.

At the front, road construction is mostly by hand labor, though combat engineers are equipped with air compressors, bulldozers, and other power machinery which can be used in some situations; most modern road construction equipment, however, is too unwieldy for use at the front.

Bridge building is the most familiar and probably the most spectacular of the feats of the engineers. Even getting troops across an unfordable stream under fire can now be effected with speed and surprising safety. Such attempts would ordinarily be made at night or under cover of a smoke screen. Equipment for such work includes assault boats. These are light skiffs of quarter-inch plywood, ten of which can be carried in a light truck. American officers prefer these to inflatable rubber boats being used by

pioneer troops on the continent. Each skiff carries eleven fully equipped soldiers—nine infantrymen and two engineers. These boats have been proven very practical in recent tests. All the weapons used by the infantry can be carried in the individual assault boats with the exception of their 37 mm. anti-tank gun. Several assault boats can quickly be assembled into rafts to ferry these anti-tank guns and the light trucks which draw them. When wide rivers must be crossed, the engineers have pontoon boats driven by large outboard motors. These boats will carry 58 soldiers in addition to the crew.

Once the advance party has a footing on the opposite shore, the engineers rig a sectional foot bridge. Four 1½-ton trucks carry floats, duckboard sections, and cables for the construction of such a foot-bridge 432 ft. in length. Under favorable conditions a bridge of that length can be constructed in the field in less than half an hour.

Regular pontoon-bridge equipment may be either light or heavy, construction methods being the same with each. The pontoons are scow-shaped craft, light ones weighing about 1,400 lbs. Anchored at sixteen-foot intervals, the bridge they support will hold light field guns, fully loaded three-ton trucks, and even light tanks. Reenforced with extra pontoons they can be used by medium tanks. Light pontoon companies carry equipment for 1,000 feet of bridge, and they can build about 100 feet of bridge an hour. Heavy pontoons similiarly made, weigh about 1½ tons, and make a bridge that will carry 155 mm. guns and medium tanks. The Engineers also carry portable bridge equipment for use where pontoon bridge construction is impracticable. This equipment includes steel highway bridges of twenty-ton capacity and seventy-two-foot span.

Camouflage

Officers of the Engineers Board at Fort Belvoir have done much valuable experimental work in camouflage, and a Los Angeles reserve battalion, most of whose officers are motion picture technicians, has accomplished remarkable results in camouflage of industrial plants. Since the enemy is so much more dangerous when he is in the air than when he is anywhere else, hiding from airplane observation forms the chief reason for the existence of camouflage. Camouflage does not imply complete concealment; the lessening of visibility of a target to delay recognition is often all that is desired.

Camouflage is an artful science. Two forms of camouflage exist. These may be classified as military and industrial camouflage. Military camouflage is created to keep enemy observers from knowing what our forces are doing and to hide from the enemy our offensive weapons.

Industrial camouflage concerns itself with the blurring of huge targets such as munition plants from planes which must unload their bombs while from three to five miles away from their target.

The Engineers Board at Ft. Belvoir has nine officers developing camouflage experiments. The 4th Engineer Battalion at Fort Belvoir has 100 officers and men working at camouflage construction. Air

(*Continued on page 26*)

Tank being ferried across stream on pre-fabricated raft.

The Ears of Our Army

CLYDE H. LOUGHRIDGE , JR., ME '43

ENEMY bombers winging their way towards our shores can now be detected by the Signal Corps' new aircraft warning device. Not only can the direction of flight and altitude be obtained, but also the speed of enemy craft. This data is determined from the speed and angle of reflection of short radio waves as they return to the sending stations after contacting enemy planes far out over the ocean.

The Signal Corps' aircraft warning engineers have been working on the device for six years at Fort Monmouth, New Jersey. There they now have a well-guarded area containing laboratories, mobile units, and radio towers.

In the shadow of these experimental towers twenty Cornellians, of whom I had the good fortune to be one, camped for six weeks last summer as part of their training in the R.O.T.C. Along with the Cornell group were men from Georgia Tech, M.I.T., and Carnegie Tech, totaling 73. The officer personnel included four reserve captains, one reserve lieutenant, and three non-commissioned officers of the regular army. The students were practically all electrical or mechanical engineers with at least two years of R.O.T.C. training. The purpose of the camp was to give us practical experience in signal communication, a real camp experience, and a picture of other branches of the service.

The Army's new "walkie-talkie"

Routine

Camp routine was similar to all army camps, with first call at 5:45, when we all scrambled out of our mosquito bars and into O.D. uniforms for reveille at 6:00 A. M. After a breakfast of cereal, fruit, hamburg on toast, potatoes and coffee, we were ready to begin the day's activities. We cleaned up the camp area, and marched to our baseball diamond for calisthenics and drill. Precision movement was stressed as we limbered up to "in caDENCE-HEX-er-cise! Hut, two, three, four; hut, two, three, four."

The students themselves took over the positions of company commander, first sergeant, and lieutenant, sergeant, or guide of each of the two platoons. These commands were rotated so that each student had the opportunity to perform the duties of the different officers. Drilling at the command of these student officers, we concentrated on the qualities of leadership necessary to command men effectively, taking note of the constructive criticism given the student officers by Captain Dodge and Sergeant Goodman, our Cornell representatives in the officer personnel.

In the instruction periods, from 9 to 12 A. M. and from 1 to 4:00 P. M. we studied first the various agencies of signal communication and then their application to actual field problems. Starting off with fundamentals, we practiced making field wire splices. Next came the various ties used to anchor wire in the field.

The first communication equipment to be used at camp was telephone switchboards and local phones. We went to work in small groups hauling the switchboards and telephones from the supply garage to suitable locations for use. Up went the switchboards and out went the wire lines in short order, as the

No, not the family's vacation trailer—it's a mobile pigeon loft, home of "two way" pigeons.

portable field boards, BD7, are made ready for use by merely unfolding the legs and opening one side of the 9"x14"x25" wooden case. We connected the outgoing wire lines to the terminal strip, labeling and tagging each circuit as it was put in. On the other end of these lines were army field telephones. Back at the switchboard the student operating it is becoming familiar with operating phases and the procedure for putting through routine and urgent calls.

Telegraph Communication

The second, and most used, agency of wire communication is the telegraph. It is the most rapid and accurate electrical means of communication, and has greater range than the telephone.

The telegraph instrument which we used was the new TG5, a compact unit in a metal case, the side of which opens out giving access to the key and ear phone. These sets can be used on a single metallic line with ground return or, for better reception and less danger of enemy interception, on a complete metallic circuit. However, when a metallic telephone circuit is on hand, a telegraph circuit with ground return may be simplexed on the metallic circuit without mutual interference.

The Morse Code is used for all TG transmissions, but because of direct wire connections, it is unnecessary to encipher telegraph messages.

Another important phase of wire communication is "trouble shooting". We would just get the telephone and telegraph system operating nicely when one of the officers, unobserved by the trouble shooter, would short the wires with a pin or cut them someplace along the line. It was then the job of the test and trouble man, armed with a test set consisting of an EE-4 phone plus a pair of test clips, to locate the short or open with his test set. When the trouble had been found, the rest of us got some more practice in splicing wires.

Besides wire communication our schedule called for a lot of work on radio, the most effective means of communication for rapidly moving combat troops. Most of our time was spent on radio telegraphy which necessitated the use of the International Morse Code. The students were familiar with the code from previous work on that subject at school and could receive from 5 to 10 words per minute. Of course the radio hams in the group tried to speed things up, as some of them were capable of taking from 15 to 25 words per minute.

The two types of radio sets which received most abuse were the SCR 131 and SCR 171. The former is a portable field set with a loop antenna and a hand cranked generator which gives it a range of about 5 miles, depending on the screening effects of hills or power line interference.

The 171 is identical, except it has a wire antenna which is strung between two 7-foot poles 65 feet apart. This set has a range of 15 miles.

As in the case of wire communication, we were split up into small groups for operation of these sets. Each group was a station and the 3 or 4 stations were all working in one net and, of course, on the same frequency. Before the groups took their assigned positions, an operating frequency was designated and each station was given a call sign.

To save time in setting up radio nets and in handling net traffic a

group of procedure signs and signals has been devised. It was part of our job to memorize these signals and use them in accordance with proper radio procedure. For example, when the other stations have had time to tune their sets, the net control station operator tells his generator man to start cranking and he sends out "ABC V AB ZGQ ZGT TWO U AR". ABC V AB is the call and in this case means that the N.C.S., whose call sign is AB, is calling all other stations in the net. The V means from. ZGQ means that the N.C.S. is reporting into the net; ZGT TWO means that the net is free (that messages may be sent without obtaining permission from the N.C.S.); U means I am the N.C.S.; and finally, AR means closing of transmission to receive your answer. The other stations then answer alphabetically, reporting back to the N.C.S. his signal strength and readability by means of more signals. And so the communication proceeds, the log operator making a permanent record of all net traffic, while the key operator does the sending with the necessary assistance of the generator man.

The "Walkie Talkie"

Another new type of radio with which we worked is known as the "walkie talkie". These sets are carried on the operator's back, and permit radiotelephony, voice communication. The antenna is a collapsible ten-foot rod extending upwards from the radio pack on the operator's back. Extremely useful for reconnaissance work, they have a range of 5 miles.

Of the several types of visual communication, the panel system was the only one dealt with at camp. The purpose of panels is to afford combat troops a means of communication with liaison airplanes. The panels themselves are 2′ x 12′ oblongs of white cotton and are provided with metal pins for staking them to the ground. The Air-Ground Liaison Code is used. It is so constructed that all words necessary for this type of communication are represented by groups of three numbers. Two panels may be arranged to mean any number from zero to nine. So with a set of panels and the Air-Ground Liaison Code, two men can communicate effectively with a friendly airplane. The pilot then radios his reply or drops the message to the ground.

Last year, when airplanes were not in such demand, the R.O.T.C. students had the opportunity to go up in planes to read panels set out by a ground crew. This year, however, things were different. One group would rush from bushes, pin the panels in a level open clearing, and duck for cover again. The rest of us standing nearby read and decoded the panels. It was not as thrilling as an airplane ride, but it saved Uncle Sam some money, and we learned how it was done.

About Pigeons

Within a stone's throw of our last row of tents, and also beside the aircraft warning area, is located the U. S. Army Pigeon Training Center. Here over 2000 birds are in training, not for a year or two years, but for a lifetime of continuous service in a very important phase of emergency communication. As Lieutent Colonel McClure said in a pigeon lecture, one pigeon in the loft is not worth very much, but when the lives of a whole company or battalion are saved because he delivered their message, or when a photograph taken by a tiny camera strapped to his breast helps take an enemy objective, he is invaluable. The lieutenant went on to tell us how pigeons are fed and cared for in the field, their uses and misuses. The latest development in the field of pigeon communication is two-way pigeons that will fly back and forth between a permanent loft and a mobile loft.

There we have it—telephone, telepgraph, radio, panels, and pigeons—the various methods of communication which we studied. Put them all together in an infantry division signal communications system, and you have a tactical field problem of the sort that we worked on for the last two weeks of camp.

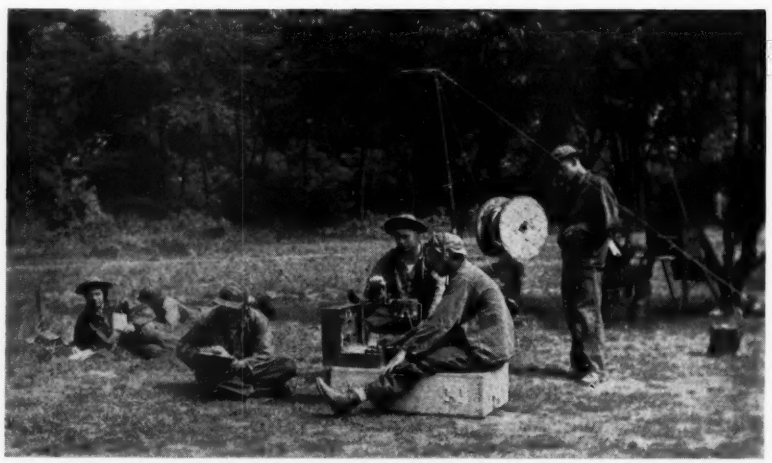
We marched over to what is left of the fort golf course. They have built barracks on three of the nine holes. There we were met by our supply trucks from which we unloaded radios, telephones, switchboards, TG sets, wire carts, and reels, batteries, test clips, ground stakes, terminal strips, and everything else essential to a division communications system. Every man had a job as assigned by the signal operations instructions. Consulting the line route map and circuit diagram, the wire chief supervised installation of the wire lines between division and brigades. The main objective was to get communications through fast. Consequently, the telephone switchboards were set up first, then the TG's simplexed, and the radios tuned up almost simultaneously.

Deciphering Messages

Attached to each headquarters is a message center which receives, transmits, and delivers all messages. It is the message center chief who decides whether a message will be sent by radio, telegraph, tele-

(*Continued on page* 28)

R.O.T.C. group operating radio.



The COLLEGE . . .

A.S.M.E. Meets

AT THE October 21st meeting of the Cornell University student branch of the A.S.M.E., Harte Cooke, who is teaching part of the course in Diesel engines being given to a group of Naval ensigns in training here at Cornell, gave an interesting talk on Diesel engines. Describing briefly the early life and experimentation of Dr. Diesel, Mr. Cooke went on to explain problems in fuels, lubrication, and design encountered in early models and how they were met in subsequent models. An early model, he pointed out, weighed 190,000 pounds and developed 500 hp. whereas recent Diesels weigh considerably less for the horsepower produced—being as little as 35 lb/hp. Numerous slides of Diesels in various types of installation and service were shown and explained. Mr. Cooke discussed the application of the Diesel to marine service and also told how Germany is conducting research in aircraft Diesel engines because of her shortage of aviation fuel. In Germany gasoline costs in the neighborhood of $.60 per gallon while Diesel fuel is but $.15 per gallon. Mr. Cook said that a five-ton Diesel truck compared to a five-ton gasoline truck cut down operation costs by 65 per cent.

A.I.E.E.

ON FRIDAY evening, October 24, the student branch of the A.I.E.E. held its first meeting of the term in a joint session with the Ithaca section. Guest speaker at the meeting was Professor Lloyd P. Smith of the Physics Department who gave a highly entertaining and instructive talk on the basic phenomena involved in "Microwave Resonators and their Excitation." A member of the Cornell Physics Department faculty since 1932, Professor Smith has recently been associated with the Radio Corporation of America as a consultant in the field of electronics and high frequency phenomena and especially in the rapidly growing field of microwave utilization, now playing an important part in defense activities.

Preceeding the meeting, the officers of both the Ithaca Section and the Cornell Student Branch attended a supper at Willard Straight Hall.

This first meeting of the school year was unusually well attended, with over 160 persons present. All were served cider and doughnuts in a social get together that followed Professor Smith's talk.

A.S.C.E.

WITH many of the architects as guests on Thursday night, November 13, the Cornell Chapter of the A.S.C.E. held their second meeting of the year. M. A. Singer and C. T. Woods, representatives of the National Fireproofing Company were the speakers. With the aid of a sound movie "Pioneering—Yesterday, Today, and Tomorrow" they discussed their product, clay building tile. The film traced step by step the manufacture of building tile from fire clay. The clay is mined, then crushed, ground, and mixed with water. When it is partially dried, it is pressed through a form to give it the desired cross section. Then the individual pieces are cut by a machine from a moving column of clay. The tile blocks are dried for four days and then fired in a kiln. After a couple of other processes and inspection the tile is ready for use as a facing for fireproof steel structures.

At the end of the meeting a gang of hungry architects and civil engineers made short work of the refreshments.

Senior Lecture

SENIORS in AE, ME, and EE heard an instructive talk by Maynard M. Boring of the General Electric Company on the employment prospects for this year's crop of engineering graduates on Friday, October 31st.

Mr. Boring has interviewed approximately 75,000 college students desiring jobs with General Electric, and with this experience as a background gave seniors a number of important tips on employment. Among the outstanding were:

1. Keep your mind open regarding your line of work.
2. Know the names of the important officers of the company whose representative you interview.
3. Learn to size up your interviewer and act accordingly.
4. Look for the type of job in which you are interested, even if you expect to be in the Army or Navy upon graduation.
5. Don't go into an interview unless you are interested in the company, for you may cut some classmate out of an offer for a job.

Mr. Boring declared that engineering graduates this June will have no trouble getting jobs and therefore should not be hasty in accepting a position.

Railroad Club

ON THURSDAY night, November 13, about 40 persons attended an interesting meeting of the Cornell Railroad Club. They heard a speech from Ken Kander, CE '44, the secretary of the club, and saw the movie, "Link and Pin". Ken related to the members of the club his experiences as agent and operator of the Long Valley station of the Central Railroad of New Jersey. He told of handling freight, Western Union, making out way bills, telegraphing other stations, and doing the million and one other things that make up a station agent's day.

The movie, "Link and Pin", told the story of the Monson Railroad in Maine, the only 2 foot gauge railroad in operation today. This line runs solely for the purpose of carrying stone 8 miles from a quarry at Monson to the Bangor-Aroostock Railroad at Monson Junction. A toy-like locomotive and 15 to 20 small cars make up the rolling stock. Two of the other unique features of the line are the use of links and pins as couplers and the use of the hand brake. These two things were in standard

use on the railroads 50 years ago so it can be seen that this line is a real "old timer."

Defense Training

AN enrollment of 2,087 in the new series of Engineering, Science, and Management Defense Training courses now offered by Cornell surpasses all previous figures by approximately 500, according to Assistant Dean Arthur S. Adams, director of the program.

These students, half of whom are enrolled in Buffalo and the others in nine other training centers in the territory allowed Cornell by the Federal Government, are taking evening courses without tuition charge under the plan sponsored by the United States Office of Education.

Totals for the ten centers, where courses are given by the Cornell faculty with facilities furnished by local educational institutions, are Buffalo, 1,096; Binghamton, 302; Ithaca, 143; Sidney, 119; Elmira, 103; Auburn, 98; Corning, 84; Endicott, 82; Geneva, 45; and Montour Falls, 15.

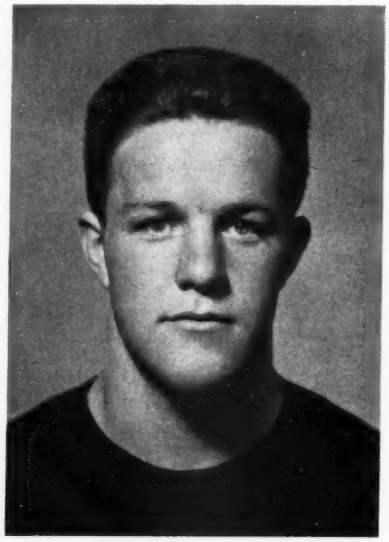
Courses in Ithaca have the following enrollments: Material Testing and Inspecting, 17; Tool Engineering, 19; Machine Design, 15; Time and Motion Studies, 22; and Personnel Management, 70. A course in Sanitary Engineering is still in process of organization.

All courses in the current program will continue for 16 weeks, and are given in the evenings in order not to interfere with the regular working hours of men engaged in defense industries, who are taking the training courses in order to qualify for more responsible positions.

New Ensigns

A NEW contingent of 54 ensigns of the U. S. Naval Reserve arrived in Ithaca in November to begin a 16-week course in instruction in the operation and maintenance of Diesel engines. This is the third group of ensigns assigned to Cornell under the Engineering, Science, and Management Defense Training program, by a special arrangement with the U. S. Office of Education and the Navy Department.

Officials of the College of Engineering, including Dean S. C. Hollister, Assistant Dean Arthur S. Adams, and Professor A. C. Davis, welcomed the ensigns at a special assembly in West Sibley. Instruction began immediately under the direction of Professor Davis and seven other members of the engineering faculty, of whom five are giving full time to this work.



New Football Captain

KENNETH L. Stofer, AE '43, 185 pound right halfback from Lakewood, Ohio, was elected captain of the 1942 Cornell varsity football team in the last official act of the 1941 squad. His brother and coach, "Jeff" Stofer, was a great All-American wing back at Cornell in 1935.

This year's captain was Peter M. Wolff, AE '42 from Highland Park, Illinois.

The new ensigns had already had five months in the Navy, under a special program for training officers for active service with the fleet. They had three months in the Reserve Midshipmen's School operated by the Navy in Evanston, Ill., including a cruise to give them the fundamentals of military discipline, shipboard life, and naval procedure, and also had two months in the Navy's Local Defense Forces School in Boston, where they learned practical details of minesweeping and patrol activities. The course at Cornell is designed to train them specifically as engineer officers on patrol vessels with the fleet.

The College of Engineering has prepared special classroom facilities for the ensigns in the Engineering Laboratory Annex north of Franklin Hall, and has also set aside additional laboratory space for their use in the West Mechanical Laboratory. New equipment acquired during the past year has given the College one of the best Diesel engine laboratories in any technical school in this country.

Tau Beta Pi

Two weeks ago Tau Beta Pi nearly doubled its rolls with the influx of twelve new men, ten seniors and two juniors. Only thirteen members were left over from last year. The newly elected president is John Dingle, AEME. His fellow officers are Dick Graham, vice president; Ferd Schoedinger, recording secretary; Bob Gundlach, treasurer; and Julie Smith, corresponding secretary.

The newly-elected senior members are Mateo Go, CE; John Mattern, CE; Adna Dobson, CE; Irving Gertzog, ChemE; Allen Cramer, Arch.; Jay Miller, AEME; Gifford Bull, ME; Lee Turner, ME; William Cochrane, EE; and Joe Littleton, EE. Juniors are William Sens, ME, and Nick Kruse, ChemE. These pledges will be initiated sometime in December, when the annual banquet will be held.

One project on which Tau Beta Pi is now working is a new bulletin board to go up in Sibley Dome to advertise the meetings and elections of all the engineering societies. It will have daily and hourly columns, so that information may be definite.

Complete Courses

WITH the completion of a 16-weeks' course in Diesel engines instruction, 37 ensigns of the U. S. Naval Reserve studying at Cornell University were awarded grad-

uation certificates at exercises on Friday, October 24, in the Main Lecture Room of Baker Laboratory.

Dr. Arthur S. Adams, Assistant Dean of the College of Engineering and director of Engineering Defense Training Courses presided. The graduation address was delivered by Dean S. C. Hollister. Prof. A. C. Davis, in charge of Diesel courses, presented the class to Captain Paul P. Blackburn, director of the Third Naval Reserve District. Captain Blackburn gave an address and presented the certificates.

The course started July 7 and has covered instruction on theory, operation, and maintenance of Diesel engines. The ensigns were assigned to Cornell for temporary duty under instruction for the period of their Diesel course. This class was the second given here for ensigns, the first, with an enrollment of 42, having taken place from March 31 to July 19 this year. A third course started here November 3 for 54 ensigns.

Buffalo Graduates

FREDRIC E. Flader, chief engineer of the Curtiss-Wright Corporation airplane division, presented on the evening of November 7 diplomas to 53 men of the Kenmore and Airport plants of the company for completion of technical courses in the engineering defense program conducted in Buffalo by Cornell University.

Dr. Arthur S. Adams, director of the engineering training program, pointed out that the training started in Buffalo thirteen months ago and that now about 1,000 men are enrolled. Three of those who received diplomas, Charles J. Fiden, Edward W. Friend and Cosmo L. Grizanti, received certificates for two courses, representing nine hours of classes a week on their own time. Many of those who received certificates will continue in other courses, Dr. Adams said.

The studies for which the men received certificates include tool engineering, elementary mechanics and design, elementary aircraft structure, physical metallurgy, intermediate mechanics of aircraft structures, machine design and mechanics and elementary design of aircraft structures II.

Flader told the men that "education is a highway to a better job, greater accomplishment and more satisfaction out of life." He expressed the appreciation of the company for the work of the Cornell University staff and to Alex Noble, engineering manager, for his cooperation with the University.

Members of the Cornell staff attending, besides Dr. Adams, were John F. R. McManus, in charge of the Buffalo defense courses, and Fred Ocvirk, instructor in aircraft design.

Building Program

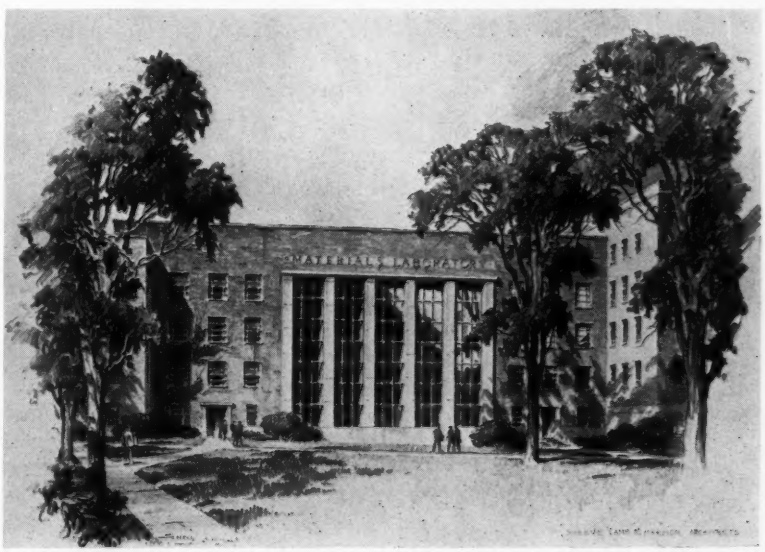
A NEW booklet, "The Materials and Metallurgy Laboratory for Cornell University," has been issued by the University to describe the new building most seriously needed by the College of Engineering now that Olin Hall has been provided for the School of Chemical Engineering. Printed in two colors and well illustrated, the booklet outlines the general plan for the laboratory and gives a full page description of each of the four major units—Materials Testing, Metal Processing, Applied Metallurgy, and Non-Metallic Materials.

Pointing out that Cornell, since the days when Robert H. Thurston established here the finest materials laboratory of the time, has always recognized the importance of fundamental and detailed knowledge of engineering materials, the statement continues, "The rapid development of materials suitable for engineering construction and operation has enormously increased the range and complexity of equipment needed for their study and control. Expansion of facilities for instruction and research must continue as new materials are produced and familiar ones improved."

Reiterating the general theme of the earlier brochure, "The New Challenge to Engineering," the statement emphasizes that "Cornell's program is based on the axiom that the engineer must always face the future. In these times especially, it is imperative that he be equipped to keep pace with the rapid advance of science, so that new discoveries may be given practical application without delay. Whether the basic problem is national defense, as today, or world reconstruction, as surely it will be later, the engineer's task will demand greater breadth of understanding and depth of technical knowledge. In no phase of engineering has the need for strengthening the educational program been more keenly felt than in that concerned with materials."

Copies of both booklets are now available for distribution to interested alumni, and may be obtained from the Office of the Provost.

Proposed New Materials and Metallurgy Laboratory



Little John

John R. Dingle, AE

IT WAS the fall of 1938 when John Dingle first came from his native Cleveland to enter the College of Engineering. In the little over three years that have passed since, he has managed to make a record for himself, both scholastically and in extra-curricular activities, that stamps him as one of the outstanding men of the Class of '42.

Upon his arrival at Cornell, John, (like the great majority of freshmen), was struck by the cosmopolitan atmosphere, the large number of students from all over the United States and from other countries, and especially by the number and diversity of extra-curricular activities open to students. His one regret is that his course in AEME is not a five year course so that he might have the time to engage in more of these outside activities.

During his frosh year, John played freshman tennis and basketball, and made high enough marks in his classwork to be placed on the Dean's Honor List. His name has appeared on that list ever since.

John shows further proof of his versatility by the various ways in which he has spent his summers. He was a counselor in a boy's camp one summer. After his sophomore year he and a friend from Dartmouth toured the Eastern Amateur tennis circuit. John spent last summer getting practical engineering experience working as a draftsman.

In the meantime, he was not wasting his winters at Cornell and his efforts were rewarded in the fall of his junior year when he was elected to Tau Beta Pi. The pressure of his work forced him to give up his basketball midway during the winter, but he did find time to be one of the outstanding members of the tennis team and a member of the Willard Straight Johnny Parson's Club Committee. Other honorary societies to which he has been elected include Kappa Tau Chi, honorary A. E. society, and Sphinx Head. This year he received parhaps his greatest honor when he was elected president of Tau Beta Pi.

As if all of the above were not enough, John also took the advanced R.O.T.C. course in Ordnance, spending six weeks during this last summer at the Army Ordnance Camp in Aberdeen, Maryland. As usual, John did excellent work and was rewarded by election to "Scabbard and Blade", honorary military society. He is a Cadet First Lieutenant and a member of the Officer's Club.

Although he expects to go directly into the Army following graduation, John hopes later to get into the production end of industry and eventually to obtain a selling job.

Prof. Raymond W. Ager

NEVER let it be said that Cornell does not possess its share of professors who are regular fellows. The ranks of this group have recently been swelled by the head of our new High-Voltage Laboratory, Professor Raymond W. Ager. Fresh from the Pacific Coast, where he taught at the University of California, Professor Ager has crossed and recrossed several mountain passes in the High Sierras. Though hiking might be called one of his chief interests, he has also had extensive experience in hunting and fishing while sojourning in the hills. And from one sportsman to another, there's nothing like a little fly-casting in a crystal-clear mountain lake after an arduous all-day climb. One of Professor Ager's favorite haunts is a shimmering lake, two days' walk from the nearest road and 500 feet above sea-level. Now that he has come east, the professor intends to try out our lakes and hills. His winter enthusiasm seems to run towards skiing, which he intends to pursue this coming season.

Profesor Ager comes to us with a world of experience. Graduating from the California Institute of Technology in 1922, he went to work for the City of Los Angeles.

New Professor

After a short while we find him working for the Southern Calfiornia Edison Company, where he was put in charge of insulators for high-voltage lines. By the way, for several years Professor Ager was the only trained inspector of high voltage insulators on the Pacific Coast. As a result of his wide experience in this field, he was put in charge of research on insulators in the Edison Company's million-volt laboratory in Southern California. After working here for eight years, Professor Ager went back to study for his doctor's degree, which he received in 1932. Since then our professor has taught at the Universities of Texas and California and recently has worked on defense machinery at General Electric in Lynn, Mass. In regard to honors, Professor Ager is a charter member

(Continued on page 26)

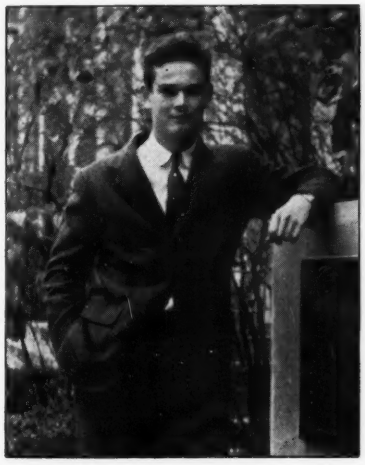
mon Cornell's
Engrs

Richard A. Graham, ME

DICK Graham is one of the most widely known engineers on the campus. "Gunga", as he is known to his friends, made his first bid for fame by placing second in a baby contest at the age of two. Someone told us that he hasn't done much since, but these few paragraphs prove a different story.

Dick received his preparatory education at the Milwaukee Country Day School. Since he had always admired Cornell, and has an aptitude for things mechanical, he came here to take his mechanical engineering.

He finished his frosh year with a McMullen Scholarship, and freshman track numerals. During his



Engineers' Councilman

sophomore year, he won his "C" as a fullback on the 150 lb. football team. Dick didn't stop there; he went on to enter the basketball competition for managers, in which he was one of the three winners.

Having been on the Dean's List for two years, Dick was awarded the Atmos Award for the sophomore on the Dean's List participating most extensively in outside activities.

In his junior year, Dick really hit his stride. He was elected president of Red Key and was elected to the Student Engineers' Council. He also took up a number of other sidelines, being chairman of the High Voltage Hop and manager of the ME exhibit on Cornell Day. He also kept up his football and his assistant managership of the Jayvee basketball team.

This year he is going to town with more than a little to do. He is chairman of the Freshman Advisory Committee, vice-president of

(*Continued on page 22*)

George F. Critchlow, EE

IN THE E.E. senior class there are dozens of men, each of whom excels in one or two particular fields; but it is doubtful that many could be found who have gone so far along as many different paths as George Critchlow. George has a commendable record in activities on the hill, as evidenced by his being co-captain of the swimming team, member of the Big Red R.O.T.C. Band and the University Symphony Orchestra, member of the Men's Instrumental Club until its discontinuance last year, and his work in Alpha Phi Omega, national service fraternity, during his first two years. He was honored in his junior year by being elected to both Tau Beta Pi and Eta Kappa Nu, electrical engineering society, becoming recording secretary of the latter. George belongs to CEM, the social engineering fraternity at Cornell, and was recently elected by his classmates to the Student Committee on Academic Conduct. Scholarship? Oh yes, he ranks second in his class.

What does George have to say about all this? "I'm not trying to set any records for accomplishment," he claims. "I participate in anything only because I really enjoy doing it—swimming, music, or engineering." Mark that last word. George says that liking your work is the main key to high grades. Good advice from someone who should know.

Born in 1920 at Trenton, N. J., he still makes this his permanent home. His grandfather, father, and two older brothers having been Cornellians, it is not hard to discover why George happened to choose this school to help him attain his goal of becoming an engineer. Incidentally, his grandfather was George S. Moler, Professor of Physics at Cornell for many years.

George spent the summer following his freshman year repairing two houses which his famliy owns, a cottage on Cayuga Lake and a three family house on University Avenue. He is still acting as landlord of the latter. After his sophomore year he worked as assistant waterfront director at the Ithaca Boy Scout Camp and as a waiter at Lake Placid, N. Y. Last summer George worked in the maintenance department of the Dravo Corporation in Pittsburgh. One of his many jobs was to inspect carefully the condition of sixty odd steel barges used to transport cement, sand, and gravel.

In addition to the activities already mentioned, George is interested in photography, tennis, and even composes some "strictly private" music. His friends will tell you that he combines a warm personality with an unusually keen engineering mind.

Having started in his freshman year as an ME, George transferred to the EE school and will receive his B.E.E. degree this June; he is coming back next year to complete a five year course and get his B.M.E. He is taking the power option in both schools. Eventually he hopes to go into research work in the electric power field.

Swimmer

CORNELL SOCIETY OF ENGINEERS

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80 Park Place, Newark, N. J.

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the College and the alumni."

President's Message

Fellow Cornellians:

Anyone who has undertaken to produce interesting photographs or paintings knows that one of the desiderata is a background—something which complements the subject of the production. It may be massive or elaborate, as for instance the Grand Tetons of the Jackson Hole country of Wyoming, or it may a very modest, simple suggestion, such as characterizes the paintings of Corot. It is always there, always apparent, for if it were taken away the picture would be shallow—almost meaningless.

All through nature, both material and human, backgrounds appear, even in such an intricate subject as a University. So Cornell has a background. Let's look at it a bit.

What would naturally comprise the background of Cornell? Well—first of all there are its traditions, intangible somethings which immediately stamp it as distinctive. If we go back a few years and dwell on such things, we recall how Cornell pioneered in engineering, in agriculture, in veterinary medicine, in home economics, and we call up to mind mental giants, such as Thurston, Fuertes, Bailey, Law, and Van Rensselaer. If we think carefully, we relate all of these to diligent work, to production, but seldom do we think of this background in terms of the thousands of students who passed under the purview of these teachers,—students whose minds and characters were molded by the radiant influence to which they were subjected. It is these students who after their sojourn at Ithaca have gone to the four winds of the heavens and begun to create their influence, a reflection of Cornell, a reproduction of the background which they there envisaged.

Is this background of material value to Cornell? Do we often think what it may mean in the future? To be sure, the future lies largely in the hands of those to whom its immediate destinies are entrusted; but the action of these may be greatly affected, yes, even controlled by the articulate expression of those who revere the institution and recognize it as true alma mater.

Too often the articulate expression of this background is confined

C. Reeve Vanneman

to material contributions—an easy thing to do, derived from material sources of wealth, and almost synonymous with passing fancy. How seldom is that vast reservoir of practical experience, of learning derived from the expansion of the ideas born of study securely rooted in the knowledge gained at Cornell, invoked for the promotion and betterment of the institution. Here lies a real source of really worthwhile help, just as effective and productive as contributions of material wealth, but alas! too frequently completely overlooked.

We have heard often of the dangers of inbreeding when an alma mater accepts the ideas submitted by her graduates, and sometimes that all new thoughts or new ideas should come from other fields of endeavor in learning. It would be odd if this were true, for can it be that graduates who have built success in all fields for which they secured their fundamental training at their alma mater are not developers on their own initiative? Is it possible that out of the thousands of graduates, who have made their contribution to worldly success, there are none fit to carry on the traditions of Cornell? Are the only successful men those who have graduated from other seats of learning or those who have been taught under other systems of training?

An answer to those questions seems to be superfluous. There are hundreds of good Cornell men, well grounded with vast experiences, all ready and willing to return to their alma mater a full measure of devotion in contributions of their experience and the learning which they have obtained from practical developments based upon their own or allied research where necessary. Evidence of this is conspicuous on

(*Continued on page* 22)

To assure coast-to-coast telephone facilities adequate to meet future defense needs of the nation, the Bell System is constructing a 1600 mile, $20,000,000 cable line between Omaha and Sacramento.

Several newly developed "plow trains," working from opposite ends of the line, are burying the cable for maximum protection. They dig deep furrows, lay two cables in them and cover them with earth — all in one continuous operation. Their meeting will mark completion of the first *all cable* line across the continent. Carrier systems will be operated in the cables —one direction of transmission in each.

This vast project is just one of thousands in which the Bell System is now engaged to provide additional communication facilities so vital to Army, Navy and defense industries.

The ALUMNI . . .

A.I.E.E. Elects

GUSTAVUS A. Kositzky, M.E. '05, who is now chief engineer of the Ohio Bell Telephone Co., has been appointed chairman of the committee on transfers for 1941-42 of the American Institute of Electrical Engineers. He has been a member of the committee since 1939 and previously served on the membership, general power applications, communications, and the Edison Medal committee of the Institute.

After his graduation from Cornell, Kositzky worked for the New York and New Jersey Telephone Co. and was made construction engineer in 1907. In 1910 he became division plant engineer for the Pacific Telephone and Telegraph Company. He worked for this company in various sections of the country until 1919, when he became affiliated with the Central Union Telephone Co. of Chicago. In 1921 he assumed his present position with the Ohio Bell Telephone Co.

New Vice President

ELMER D. Spicer, M.E. '12, was among the five recently elected new vice presidents of the General Electric Company. He is now vice president of the Apparatus Department in charge of manufacturing. Mr. Spicer is a native of Wellsville, N. Y. Before joining General Electric in 1924, he was chief engineer and factory manager of the Kerr Turbine Company of Wellsville.

He served first on the staff of G.E.'s Manufacturing General Department and later on the staff of the superintendent of the Schenectady Works. In March, 1925, he was placed in charge of the insulator and carbon brush department. A year later he was named superintendent of the radio department. In August, 1927, soon after the company began the manufacture of refrigerators, he was made superintendent of the refrigerator department, where he remained until August, 1929, when he was appointed assistant works manager

Elmer D. Spicer

in Schenectady. On October 1, 1934, he became Schenectady Works manager, a position he held until May, 1941, when he was named assistant to the vice president in charge of general manufacturing operations.

Appointed Chairman

EDWARD C. M. Stahl, M.E. '13, who is now assistant manager of the production department in the Consolidated Edison Company of New York, has been appointed chairman of the headquarters committee for 1941-42 of the American Institute of Electrical Engineers. Tahl is also a member of the committee on power generation, and formerly (1938-39) was chairman of that committee.

After receiving his mechanical engineering degree from Cornell, he worked for the New York Central Railroad until 1920, except for the period during the war, when he served as a captain in the U. S. Army Coast Artillery Corps. In 1921 he joined the Pittsburgh Transformer Co. and worked on patent investigations. He became field engineer for the Brooklyn Edison Co. in 1922 and has since risen to his present position with the Consolidated Edison of New York.

Out Of Retirement

DR. Sanford A. Moss, a former Cornell instructor (1891-1903) who obtained his Ph.D. degree here in 1903, has come out of retirement at the age of 69 to help push the mass production of the airplane supercharger at the General Electric plants as part of the National Defense program. Dr. Moss invented the airplane supercharger, the device which makes possible the altitude, speed, and range of the modern airplane, as a General Electric employee back in 1918.

The supercharger feeds extra oxygen into the airplane engine's carburetor, maintaining sea-level atmospheric pressure at altitudes of five miles or more. Without a supercharger a 1000 hp engine would deliver less than 400 hp at 25,000 feet; with a supercharger, the full 1000 hp.

Dr. Moss formally retired in 1938 after thirty-five years of work on turbosuperchargers and gear-driven superchargers, but is once more on active duty. In the picture he is shown with an impeller, an important part of his turbosupercharger.

Use The Cornell University Placement Bureau

WILLARD STRAIGHT HALL H. H. WILLIAMS, '25, Director

"His greatest creation, the turbosupercharger, at last has come into its own," writes Hickman Powell in an article on Dr. Moss in a recent issue of Popular Science Monthly. "It has become one of the most important focal points in America's sudden war effort. No effort or expense is being spared to push its mass production. At last the sky is really the limit."

Twenty-three years ago, in order to help beat the Kaiser, Dr. Moss harnessed up a red hot tornado, sheathed it in heat-resistant metal, and hitched it to a Liberty motor at McCook Field, Ohio. Then, sheltered behind a barricade, he opened the throttle up.

The Turbosupercharger

Dr. Moss, a small scientific gentleman with a Van Dyke beard, knew perfectly well what he was doing in this seemingly irrational behavior, just as any airplane pilot today knows that you are likely to tear your engine to pieces if you open up wide at sea level with a Moss supercharger. He was giving the turbosupercharger its first demonstration, and he did his violent deed at the insistence of skeptical air corps engineers, to convince them that his odd contraption was worthy of an official test at the top of Pike's Peak, in the rarefied atmosphere it was built to conquer. At half throttle they had refused to be convinced.

On Pike's Peak, in September, 1918, the turbosupercharger proved itself. In those days an airplane engine lost power rapidly as it gained altitude because less oxygen was sucked in to mix with the fuel in the combustion chambers. The turbosupercharger was a centrifugal compressor, or fan, which forced air in sea level quantities into the engine's carburetor. In the words of Dr. Moss, it "kidded the engine into thinking it was at sea level." The compressor was revolved by a turbine, driven by a whirlwind of flaming fumes from the engine's exhaust.

The test Liberty motor, which had produced 350 horsepower at Dayton, would give only 230 horsepower at the 14,000-foot altitude of Pike's Peak. But when Dr. Moss cut in his supercharger, it gave 356 horsepower! And this full power was much more valuable than at lower altitudes, for in the thin, high atmosphere an airplane could move at high speed with much less air resistance.

Dr. Moss also developed the geared supercharger, a small centrifugal compressor built into an airplane engine, which takes its power from the engine crankshaft by means of gears. When he went into what he thought would be retirement at the age of 65, on January 1, 1938, after 35 years of engineering research for General Electric, every modern American airplane engine except a few small pleasure plane motors was equipped with a geared supercharger made from designs by Dr. Moss, and the turbosupercharger had some use on military planes. The story of the device is the story of Dr. Moss's life. At 16 he was apprenticed as a mechanic in a shop which made air compressors in San Francisco, where he was born. After finishing his four-year apprenticeship, he became an engineering student at the Universtiy of California, sweeping up the floor of the college shops to earn his way. By 1900, he had bachelor's and master's degrees and went on to Cornell University where he received his doctor's degree in 1903.

His graduate work on a projected gas turbine attracted the attention of General Electric and he went to work in the company's West Lynn, Mass., plant and there began his supercharger work during the World War for the National Advisory Committee for Aeronautics.

Important as it was, Dr. Moss's supercharger department grew slowly. For years it occupied one room and the engineering staff numbered five men. While the exhaust - driven turbosupercharger took over nicely at around 15,000 feet, making it possible for the engine to "breathe" normally up to 25,000 and even 30,000 feet and to get on comfortably up to 40,000 feet, few people wanted to fly so high.

Now all that is changed. There are turbosuperchargers on the Boeing flying fortresses, Lockheed interceptor pursuits, Republic fighters and many other planes. The engineering staff has been multiplied astronomically. Production experts have been moved in. Great factories are being rushed into commission. Millions upon millions of dollars are being poured in. Economically as well as theoretically, the sky is now the limit.

And back on the job in the midst of it all is Dr. Moss himself, called back to work as a consulting engineer—as happy, dazed and excited as two children at the circus.

Dr. Sanford A. Moss

Richard A. Graham

(*Continued from page* 17)

Sphinx Head and of Tau Beta Pi, president of the Student Engineers' Council, manager of the Junior Varsity basketball team, and is the house manager of his fraternity, Psi Upsilon. He also takes part in Scabbard and Blade, and the Officers' Club.

While talking to Dick in his room down at the Psi U house, we noticed a guitar beside his desk and a manual on teaching yourself how to play the guitar. That's right; in spite of all the things he is doing, Dick is teaching himself to play the guitar, just because he had the yen to do something musical. Right now he can play "My Country 'Tis of Thee" so that you can recognize it if he tells you what it is before he starts. However, just give him time, and he'll be playing requests.

This is characteristic of Dick. No matter how busy he is, he not only thinks about other worthwhile enterprises, but gets right in there and does something about them.

While Dick would like to spend his summers sailing and canoeing, particularly where the "big ones" are biting, he believes working experience to be essential to an engineering education. During the summers of his freshman and sophomore years, he had a job in the experimental department of Cutler-Hammer, Inc., where he and a professional engineer experimented with the effects of gun shock on D. C. submarine controls. Last summer he joined many of his classmates down in Aberdeen, Maryland, at the R.O.T.C. Ordnance camp.

In the winter his favorite sport is skiing. While at Lake Placid just before Junior Week last year, "Gunga" was watching a crowd of grade-school kids going off a ski jump, and figured that if they could do it so easily, he was at least going to try it. Zoom! He didn't mind the broken skiis so much, but it was rather uncomfortable dancing at the Prom with a broken rib.

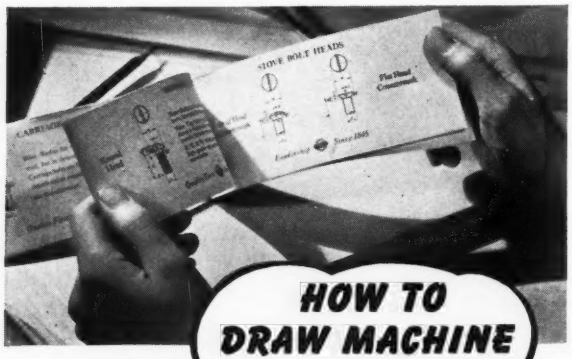
Dick says that soon after graduating he will get his commission, and will spend some time in the Army before he goes on to get a regular job. However, we all feel confident that his scholastic ability and general activity at Cornell will stand him in good stead in the business world.

President's Message

(*Continued from page* 18)

the campus today in many of the colleges, notably agriculture and architecture. Reticence keeps many other qualified men from making their ability and availability known; perhaps even the absence of invitation may deter a manifestation on the part of others. There is a yearning for this type of service, there is a desire to implement this background, both based on the spirit which comes from the heart. It should not be idly brushed aside.

A background—there is a background in Cornell. May it not be eliminated from the pictures of the future! Let's hope that each one who cherishes the recollection of all that Cornell means to him, shall see to it that any contribution of which he is capable—either material or in the form of experience and learning—shall be manifested, for there is need of it.



• The "RB&W Handbook of Common Machine Fasteners"—sent absolutely free upon request — shows the most widely accepted methods of representing more than thirty different types of standard bolts, nuts, rivets, etc., on assembly and detail drawings. This 16-page booklet will fit inside your drawing instrument case for handy reference.

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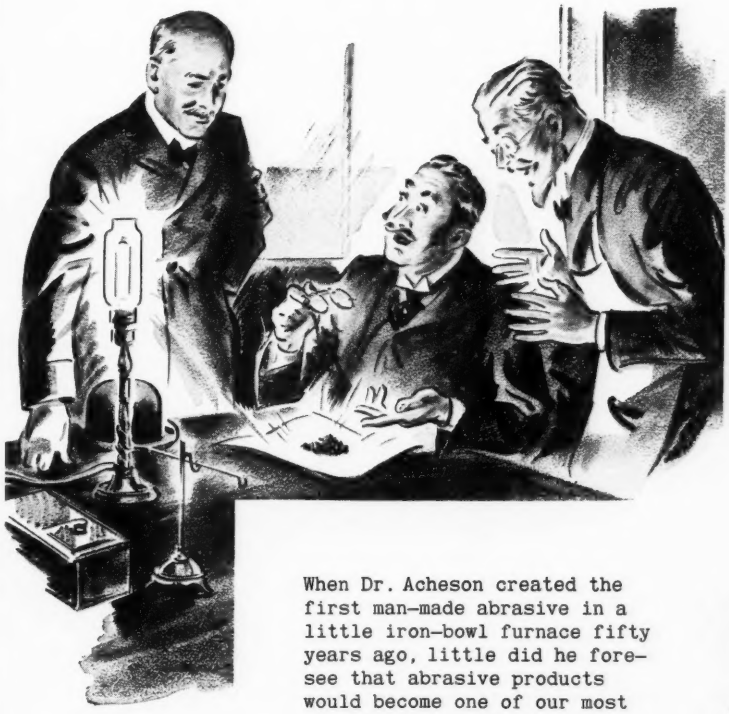

"You really made these crystals in an electric furnace?" the gem expert asked. "They look as if they'd been in the earth a million years!" "Certainly I made them", said Dr. Acheson. "And all I ask is that you crush them and try them instead of diamond dust for gem polishing." The expert did...and placed an order at $880 a pound! Today this same Carborundum Brand Silicon Carbide serves all industry, sells in grain form for as little as 16¢ a pound.

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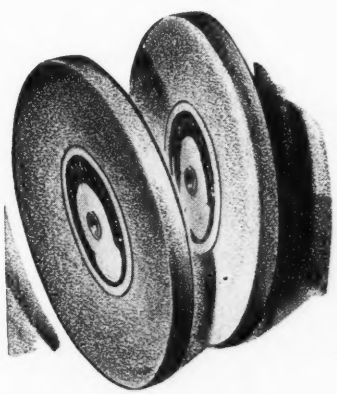

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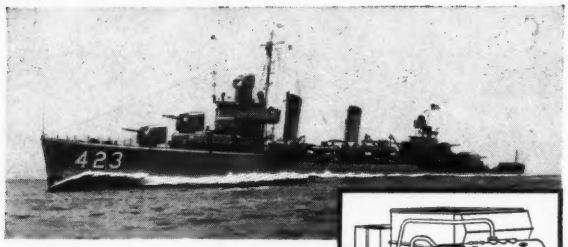

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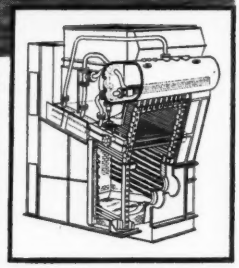

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Rubber Lifeline

(*Continued from page 7*)

small industrial trucks and dollies which move goods about inside factories. These conductive tires bleed off charges of static electricity which might be disastrous if released in armament and munitions factories.

It may not be generally known that synthetic rubber is the "sealing member" in the bullet-sealing airplane fuel tanks with which most military planes are now being equipped. This highly strategic development which stems from the Goodrich "Seal-O-Matic" puncture-sealing inner tube enables combat aircraft to survive enemy gunfire which only a few years ago would have sent them hurtling earthward in flames.

These are only a few of the uses of synthetic rubber already in wide application throughout industry. In addition, there are numerous other synthetic rubber-like substances, one of which, Koroseal, derived from coal, limestone and salt, is widely used as cable insulation, coating for fabrics, acid tank linings and in many other applications. I have not considered these in this discussion because they are usually classified as rubber-like rather than as synthetic rubbers.

The uses of synthetic rubber alone indicate, however, that these man-made substances can perform indispensable functions where rubber itself could not serve. Furthermore, present indications make it likely that the specific properties of synthetic rubber will open new fields for its use at such a rate that its ability to compete with natural rubber at the latter's lower production cost will be a secondary feature when weighed against the special services which synthetic rubber can render.

There is no question that synthetic rubber can score a notable success throughout industry without disturbing the time-honored position of natural rubber in hundreds of fields and applications where it is entirely adequate as a material. I do not want to leave any illusions, however, that this will be an over-night development. We have spent 15 years here at Goodrich developing a synthetic rubber capable of replacing natural rubber for almost any essential use. The most spectacular results with synthetic rubber have come about only in the past 16 months.

But of this we can be sure. This nation has been provided with a material on which we can rely in an emergency, and that factor alone justifies the time and money spent on its development.

Conclusion

In light of the proven capabilities of this material to render vital services, I believe the next few years will find synthetic rubber fitting itself securely into the American industrial pattern which has become so familiar since the turn of the century—the development of materials and mechanisms which cost more but offset that greater cost by rendering unique service.

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1. General four-year course leading to the degree of Bachelor of Mechanical Engineering. Options are offered in the senior year in Power-Plant Engineering, Heat Engineering, Industrial Engineering, Automotive Engineering, Aeronautical Engineering, and Hydraulic Power-Plant Engineering.
2. Five-year course leading to the degree of Bachelor of Mechanical Engineering.
3. Six-year course leading to the degrees of Bachelor of Arts and Bachelor of Mechanical Engineering.
4. Four-year course in Administrative Engineering in Mechanical Engineering, leading to the degree of Bachelor of Science in Administrative Engineering.

Electrical Engineering

1. General four-year course leading to the degree of Bachelor of Electrical Engineering.
2. Six-year course leading to the degrees of Bachelor of Arts and Bachelor of Electrical Engineering.
3. Four-year course in Administrative Engineering in Electrical Engineering leading to the degree of Bachelor of Science in Administrative Engineering.

Chemical Engineering

1. Five-year course leading to the degree of Bachelor of Chemical Engineering.

Graduate Work

Courses leading to the Master's and Doctor's degrees are available in all the above fields.

Engineering Research

Facilities are available for conducting fundamental and industrial researches in the foregoing fields in cooperation with industries.

For Detailed Information, Address
The Dean of the College of Engineering, Cornell University
Ithaca, New York

Prof. Ager

(*Continued from page 16*)

of Tau Beta Pi at Cal. Tech, associate member of Eta Kappa Nu, and a member of Sigma Xi.

At Cornell, the professor is dividing his time between teaching electrical theory to seniors and research at the High-Voltage Laboratory. He finds his students here highly interested in their work. In regard to the High-Voltage Lab, the outer shell was expected to be completed by the first of December, and research will be begun immediately. All supplies and equipment will be relatively easily obtained because an A-1J priority rating has been put on the project. Professor Ager intends to run the lab with a small and interested group composed of a technician, graduate students, and research men from the companies that have an interest in the projects. The more defense work they can get the better they'll like it.

Professor Ager has been happily married since the end of his junior year in college. Brought up in Los Angeles, both husband and wife have interested themselves in outdoor activities. On all vacations and sojourns in the country, they are always found together. If any of you are interested in hiking or fishing, why don't you drop in on Professor Ager sometime and swap stories? He's a helluva nice fellow.

Army Engineers

(*Continued from page 9*)

fields are being made to look like tobacco farms. Coast artillery positions are being dressed up as horticultural stations. Troops are being told why the north side of a bush is safer than the south side; pamphlets are being published; non-reflecting glass for windshields is being studied.

Conclusion

Water supply troops, erection of barbed wire entanglements, mine planting, and tank trapping are other details which occupy the Engineer's attention. They have developed an explosive which is as powerful and no more dangerous to handle than T.N.T. in case the supply of the latter should be limited in times of emergency.

CORRECTIONS

For last month's article by A. D. Blake on "Defense Power — from Steam," copy should read "1400 lb" instead of "100 lb" in sixth line from bottom, third column of page 12.

Also, tenth line from top, first column of page 13, in referring to the Port Washington Station should read: "Here the large 13901lb pressure boiler. . ."

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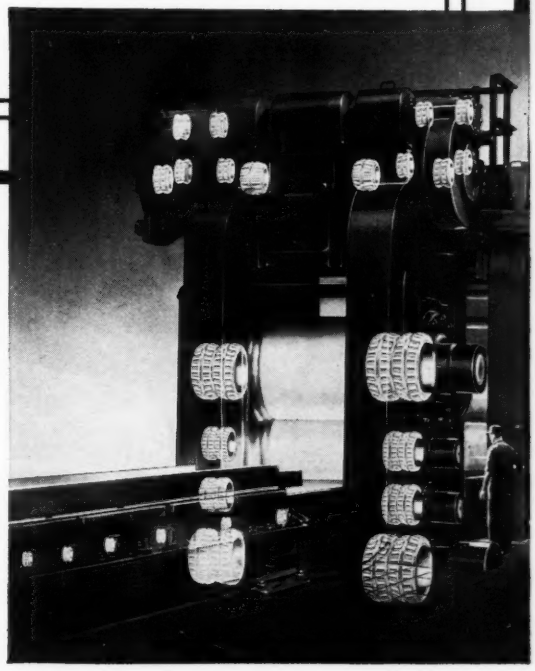

Let's assume that you were asked to design a 4-high continuous strip steel rolling mill to operate at a rolling speed of 2,000 feet per minute. What bearings would you select for the necks of the back-up and work rolls?

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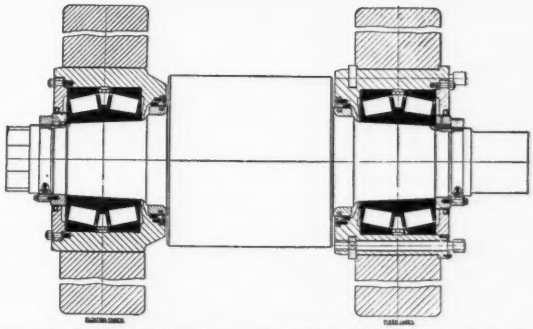

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Signal Corps

(*Continued from page* 12)

phone, or messenger. The code clerk who enciphers and deciphers radio messages is included in the message center personnel. In these exercises on the golf course we began to see more clearly how orders are executed in the field, and how all the details we had been studying fitted right into the general picture.

Included in our study program were subjects other than communications with which a signal corps officer must be familiar. Perhaps foremost among these is pistol marksmanship. Brand new Colt .45 caliber automatics were used. We spent a total of about 20 hours on this weapon, during which time we took it apart, cleaned it, learned the manual of the pistol and safety precautions, practiced sighting and triangulation, and finally fired a practice and record course on the pistol range.

Donning climbing spurs and safety belts each of us had the chance to test his skill at pole climbing. About a mile from camp were six practice poles where we spent two afternoons going up and down, discovering it was not as easy as it looked.

Chemical Warfare

Another interesting afternoon was spent on defense against chemical warfare. After a lecture on war gases and a demonstration of the use of the training masks with which we were all equipped, we were exposed to a barrage of tear gas bombs. At the command, Gas! we hurriedly put on our masks, but some of us were not quick enough, and our tear stained faces told the story.

To supplement our regular training we were shown many recent training films. The subjects of a few such films were "Military Courtesy", "Sanitation and Hygiene", "Anti-tank Defense", and "Motorized Cavalry".

In addition to training films we were taken on several very interesting inspection trips. The first of these was to the Bell Telephone Company in New York City. There we were escorted through the building in small groups, and shown maps of trunk lines, wirephoto equipment, operators putting calls through to London, Berlin, and Africa, and the operation of the dial system. At Fort Hancock we, and a large group of West Pointers, were fortunate to witness a coast artillery and anti-aircraft demonstration. In the afternoon six- and eight-inch coast artillery guns went into action. About 20 seconds after the cloud of flame and thunder left the gun, a huge geyser of water shot into the air 10 miles out in the ocean next to the towed target.

That evening when it became dark searchlights combed the air for several miles up and down the coast. Soon they spotted the target, a luminous sleeve towed at great distance behind an airplane. Then the battery of four three-inch AA guns cut loose with a machine

(*Continued on page* 30)

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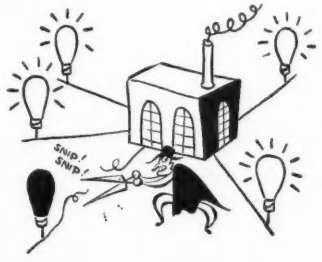


► For, in those days, the *only* means of distributing electricity was through *radial* systems, in which the power lines radiated like the spokes of a wheel with the power station as the hub. So, if *any part* of a power line were damaged, no electricity could be delivered to users *all along the line.*

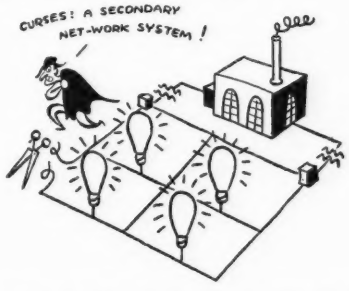
No way was known to reduce the vulnerability of power distribution until the early '20's, when engineers of a large power company conceived the idea of the *secondary network system.*

► The idea was to connect low voltage secondary lines in a *network*, with the main power (primary) lines joined to the network at several places. Thus, with power being sent along several different routes, a line could be damaged and electricity would continue to flow to its users along the other routes.

It was a great idea . . . if it could be made to work on large and complicated city systems. That was the problem, a problem which the power company brought to Westinghouse engineers.

► The secondary network system wouldn't work at all until some pump-proof method was found to keep power from flowing backwards into a damaged section of the line. Westinghouse engineer John S. Parsons (a member of Georgia Tech's class of '21, a graduate of the Westinghouse Training Course, and the holder of 30 of the 150 patents on secondary networks) found the way . . . a pump-proof relay which, when power is flowing in the wrong direction, closes its contacts and causes a network protector (automatic air circuit breaker) to trip and cut the feeder off the line.

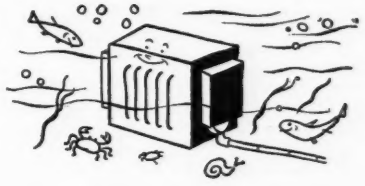
Then, there was the question of where to put the transformers, relays, and protectors that secondary networks needed. The amount of space this equipment would take up would be tremendously expensive in crowded cities.



► The obvious way to overcome this obstacle was to put this secondary network equipment underground. But transformers, relays, and protectors wouldn't perform properly in damp underground atmosphere. Westinghouse engineers went to work and developed a transformer-relay-protector unit that could fight off dampness and perform as well underground as above ground! Now, there are network units that do their job even though submerged under salt water, twice a day!

To make doubly sure that they had the space problem licked, Westinghouse engineers cut down the size and stepped up the power capacity of these network units. They made it possible for a unit that was one-third smaller to do the same electrical jobs!

► Secondary networks raised all sorts of new problems. And Westinghouse engineers had to find a lot of new answers before they were able to bring secondary networks from an idea to a working distribution system.



Today, Westinghouse engineers have brought secondary network systems to 164 cities. They've adapted these systems to the specialized needs of defense plants, army camps, airports, and power houses. Their work has contributed tremendously to today's ability to distribute unfailing electric power . . . despite lightning, accidents, and sabotage.

★ ★ ★

► This story illustrates how Westinghouse engineers work. More than that, it shows how the Westinghouse Company works. For there are 1,500 engineers in Westinghouse . . . in service, in management, in design, in sales, in every single branch of the business. These engineers give the company its point of view.

Westinghouse takes pride in the engineering behind its products. Its engineers are always analyzing its products, working over them, making them better. It has the engineer's impatience with the old and his eagerness to create the new.

► Engineers founded and built Westinghouse. Engineers will carry it on.

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Signal Corps

(*Continued from page* 28)

gun barrage of shells which exploded in rapid staccato next to the target.

On another occasion we went to the Naval Air Station at Lakehurst, New Jersey. There we inspected the observation blimps, learning their place in our coastal defense scheme.

Film Lab

Back at Fort Monmouth we went through the Signal Corps Labs and the Training Film Lab. At the former we were hurried through as hundreds of engineers, radio experts, and technicians could not pause in their rush to complete new secret equipment. However, a whole morning was spent at the Training Film Lab where Esquire's Jaro Fabrey is working in the animation department. In the editorial department the script writing and producing is done by drafted Hollywood experts.

A never-to-be-forgotten camp experience was our two day bivouac at Fort Dix. After a fifty-mile ride in new army trucks driven by students, we stopped next to the artillery range, and pitched our pup tents amid the reports of 75 mm. cannons. Dirt flew as we ditched our tents and dug large pits for garbage. After dinner, and before the Georgia Tech boys got their evening bridge game started, Captain Dodge talked to us on guard duty. We learned the general orders and guarded the camp from dark until dawn. The next morning we took an eight-mile practice march with light packs. They wanted to make sure everyone slept well the second night.

In spite of the busy program at camp there was time for athletics and amusement. We had a camp newspaper, "The R.O.T.C. Signal", a mimeographed weekly put out by the students. Then there were softball games between college teams, and between the R.O.T.C. team and the military police or pigeoneers. Other amusements included tennis, football, horse shoes, ping pong, swimming in the ocean, and movies at the Post Theater. Our morale officer, Captain Buckingham from M.I.T. arranged a dance for us at the Officers' Club, and also a beach party, both of which elevated our morale, if not that of the officers' daughters whom we escorted.

Conclusion

It has been said that the more a man knows about related jobs, the more he fully understands his own. The same reasoning applies here. The Signal Corps officer is more aware of his functioning in a coordinated drive of all arms when he knows what the other units are are doing. Effort was made at this camp to give the students a well rounded picture of the whole army as well as a knowledge of practical signal communication. When the time comes, the ears of our army will be ready.

MOUNTING POWER FOR ALLIED WAR BIRDS

THIS engine mount destined for overseas service on an American made fighter plane is being fabricated by the best known method of joining metal — that is, by welding. For welding makes equipment a homogeneous, permanent unit, light yet exceptionally strong. This versatile process utilizes the Airco oxy-acetylene flame to make design problems vanish. It is applied rapidly and economically even under difficult shop and field conditions. The apparatus employed is simple, portable, easy to operate. » » So versatile is the oxy-acetylene flame, so varied are its useful applications in the metal working field, that it has long since been drafted into service to speed defense by swiftly cutting metal to close tolerances, by hardening metal surfaces for longer wear, by cleaning them for faster, longer-lasting paint jobs, and by gouging metal with amazing speed and accuracy.

The interesting booklet "Airco in the News" shows pictorially many ways in which Airco products and processes are being used to help industry speed up production. Write for a copy.

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ANYTHING AND EVERYTHING FOR GAS WELDING OR CUTTING AND ARC WELDING

STRESS and STRAIN...

Small Boy: "Shine your shoes, mister?"

Grouch: "No."

Small Boy: "Shine your shoes so you can see your face in them?"

Grouch: "No!"

Small Boy: "Coward!"

* * *

Etiquette writers insist a woman should not overlook even the most insignificant detail of her wedding arrangements. Huh, if it weren't for him there wouldn't be any wedding.

* * *

Mother kangaroo lifting baby kangaroo out of her pouch and banging him on the head: "I'll teach you to eat crackers in bed."

—Kansas Engineer

* * *

Moe: "Who's the girl with the French heels?"

Joe: "She's my sister, and those guys aren't French."

—The Pennsylvania Triangle

A traveler who believed himself to be the sole survivor of a shipwreck upon a cannibal island hid for three days in terror of his life. Driven out by hunger, he discovered a thin wisp of smoke rising from a clump of bushes, so he crawled carefully to study the type of savages about it. Just as he reached the clump he heard a voice say: "Why in hell did you play that card?" He dropped to his knees, and devoutly raising his hands, cried: "Thanks, God, they are Christians."

* * *

A young man by the name of C. H. Fore was arrested recently in Los Angeles on a charge of intoxication. Every chemistry student will recognize CH as one of the saturated series.

* * *

Reno, we are told, is the place where the cream of society goes through the separator.

—Iowa Engineer

"Will you please move over? This is for The Cornell Engineer!"

Ike applied at a Canadian recruiting office to enlist.

"I suppose you want a commission?" said the officer in charge.

"Gosh no," was the reply, "I'm such a poor shot I'd rather work on a salary."

—Excavating Engineer

* * *

Inscription on a tombstone: "Here lies an atheist, all dressed up and no place to go."

—California Engineer

* * *

The shades of night were falling,
When for a kiss he asked her.
She must have answered "yes" because,
The shades came down much faster.

* * *

When the flood was over and Noah had freed all the animals, he returned to the ark to make sure all had left. He found two snakes in the corner, crying. They told him their sorrow:

"You told us to go forth and multiply upon the earth, and we're adders."

—Telephone Review

* * *

Remember when the women wore bustles? An historical novel is like a bustle because it is a fictitious tale based on stern realities.

* * *

Mary had a little swing,
It isn't hard to find,
And everywhere that Mary goes
The swing is just behind.

* * *

"I understand dey has finished your new church and that it will be opened soon."

"Yes, we is gwine ter desiccate and confiscate it next Sunday."

—Curtis Fly Leaf

TWO FEDERAL AGENTS
ENTER FIRE PROBE—
SABOTAGE "POSSIBLE"
Federal agents arrived today to take part in the investigation of the disastrous fire that stopped production on important defense

Learning The Cause Won't Fill The Orders

The shafts have stopped turning. Hands that can set a tool-rest to a hair are wrapped around pool cues down at Joe's place. Mirror finishes on Assembly's floor are dimming over with the first hints of rust.

Learning the cause of your fire won't help. What you wanted was the chance to produce – without Fire's interruption. Perhaps you counted on a "fire-proof" building. Or on employees trained to be ever-watchful. *You can't* – as the record of thousands of fires will show. The record proves that there's only one way to stop fire at its source. That way is automatic sprinkler fire protection.

Fortunately, there isn't the slightest need to compromise with quality when you install it. For the world's best-known fire protection system – Grinnell – can be bought as an actual cash-dividend-paying investment. The chart below proves it.

Built lock, stock and barrel by the world's leader in fire protection; prefabricated to a Grinnell-engineered layout, then installed with minimum disruption; proved dependable by eight thousand fires killed in the past ten years alone – a Grinnell System is the best guardian of spinning shafts your plant can have. Owners of fifty billion dollars' worth of the world's property have chosen it. Take *your* first step today. Write Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

QUESTIONS and ANSWERS
about Automatic Sprinkler Fire Protection

Q. Who says I'm not protected? I have complete insurance coverage!

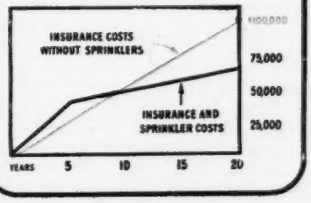
A. 43% of all burned businesses are never resumed, regardless of insurance.

Q. My building is metal; its contents are non-combustible. Why should I have sprinklers?

A. A metal mill burned to ruins in an afternoon. Oil vapor had condensed on inside walls.

Q. What do you mean – a Grinnell System pays for itself?

A. The chart shows a typical case. Insurance without Grinnell System, $5,000 yearly. With Grinnell, premium reduction paid for the system in 8-1/3 years. After that, $3,000 a year clear saving!



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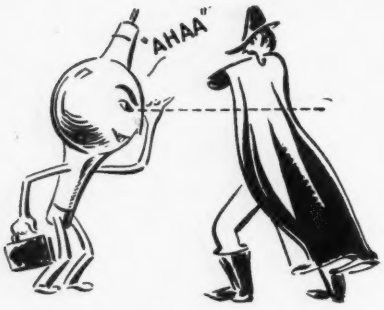
G-E Campus News



SUPER-PEEKSTER

EVEN when our defense "Sherlocks" can't, x-rays *can* "see right through" potential saboteurs and their hidden bits of destruction.

Without unwrapping or any dangerous tampering, suspicious packages may be inspected quickly and safely. Portable x-ray equipment is also used for fluoroscopic examination of overstuffed furniture, mattresses, or other articles in which questionable items might be hidden.

The x-ray has been instrumental in unearthing such things as a hypodermic needle and some narcotics cleverly hidden in a woman's handbag, a revolver baked in a loaf of bread, or hacksaw blades concealed in a cake of soap.

CURVES OF COLOR

THE most expert human eye can distinguish about 100,000 different colors, but that's practically color-blindness compared to the 2,000,000 that the G-E color analyzer can detect. The color analyzer can even measure your lady friend's blush, provided she holds it for two and a half minutes, and then, it will record it on paper for future reference!

The recording photoelectric spectrophotometer (that's the color analyzer's name) is only one of the things you can see in action in one of G.E's newest movies, "Curves of Color." This film, in full color, gives a 10-minute story of the world of color, telling why accurate color recognition is of such great importance to man and industry.

"Curves of Color" (16mm, sound) is purely educational and will gladly be lent to organized groups without any charge but the transportation costs. If you would like to show it at one of your dinners or club gatherings, just drop a line to Campus News, Dept. 318-6, General Electric Company, Schenectady, N. Y.

HOT DOGS AND COLD DIPS

THE strip mine of the Truax-Traer Coal Company in Fiatt, Illinois, hasn't actually been invaded by picnickers (yet) who want to cook hot dogs in the dipper of the big, 30-yard stripping shovel there, but it's an idea! Hot plates have been installed in the dipper, and Calrod heating elements have been put in the dipper handle.

The purpose of these heaters is not, however, to provide an extra service for possible picnickers, but to keep mud from freezing to the sides and bottom of the dipper. This used to reduce payload 50 per cent or more, and bonfires and a shutdown of 30 minutes to an hour were necessary to thaw out the frozen mass.

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